Low Power Transceiver Module

915 MHz ISM Band RF Transceiver Module

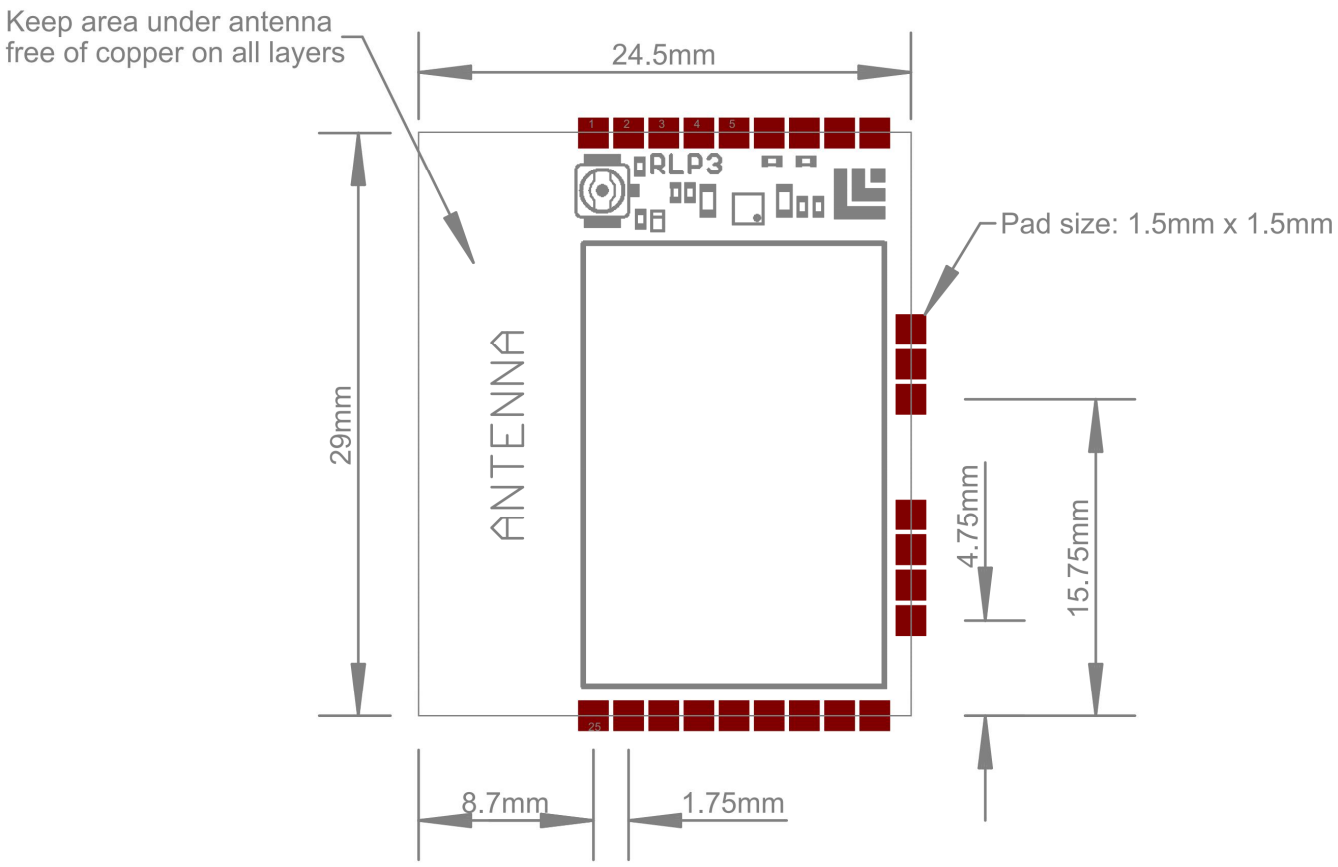
KEY FEATURES

- Receiver sensitivity: -140 dBm
- Transmit power: 70 mW
- TX Peak Current: 122 mA
- RX Peak Current: 10 mA
- Sleep current: 1 **µ**A (regulated),
  10 **µ**A (unregulated)

SPECIFICATIONS

Frequency band	915 MHz ISM (902 MHz – 928 MHz)
On-air data rate	183 bps to 37.5 kbps
Output power	Programmable: +18.5 to 4 dBm in 0.6 dB steps
Supply Voltage	3.5 V to 5.5 V
I/O Voltage	3.3 V
Tx Peak Current	122 mA
Rx Current	10 mA
Sleep Current	<1 **µ**A (regulated), 10 **µ**A (unregulated)
Dimensions	24.5 mm x 29 mm
Operating Temperature	-40 to 85° C (industrial)
UART baud rate	Default: 115200 8n1

MODULE FOOTPRINT



PINOUT

Pin #	Name	Type	Description
1	GND	Ground	
2	ANT	RF I/O	RF path if not using U.FL connector
3	VBAT	Input voltage	Module supply voltage (3.5 V to 5.5V)
4	LDO_OUT	Output voltage	Power digital. 3.3 V output
5	VCC	Input voltage	Regulated 3.3 V
6	MD/FINED	IO	FINE interface
7	nRESET	I	External reset pin, active low
8	HOST_IO0	O	Status message indicator
9	GND	Ground	
10	SDA0	IO	I²C0: serial data
11	SCL0	IO	I²C0: serial clock
12	SMISO1/SSCL1	IO	SPI1: master in slave out
13	SMOSI1/SSDA1	IO	SPI1: master out slave in
14	Reserved		
15	SCK1	IO	SPI1: serial clock
16	Reserved		
17	BOOT	I	NC = Boot normally, GND = Bootloader
18	nSS1	IO	SPI1: slave select
19	WAKEUP/FINEC	IO	FINE interface
20	DP	IO	USB Data+ (D+)
21	DM	IO	USB Data- (D-)
22	HOST_IO1	I	Analog input. 0 – VCC
23	HOST_RXIN	I	UART interface: module Rx
24	HOST_TXOUT	O	UART interface: module Tx
25	GND	Ground	

Notes:

1. RF connection is via U.FL connector on upper left side of the module or pin 2
2. RF output is 50 Ω, DC blocking cap not required
3. ALL I/O signals must be 3.3 V. If necessary, pin 4 (3.3 OUT) may be used to supply an off-module level shifter
4. Default UART baud rate is 115200 8n1

PCB LAYOUT REQUIREMENTS

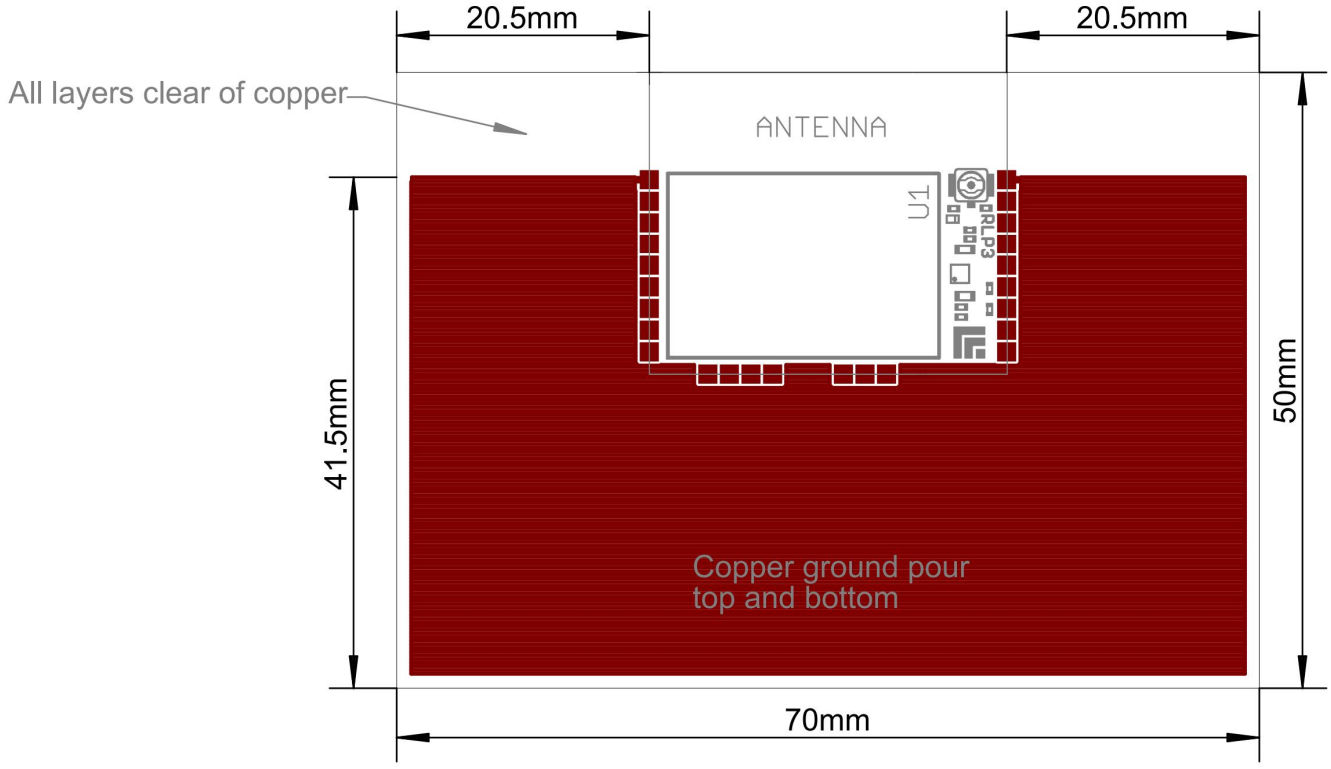
Since this module and its associated set of approved antennas has been certified by the FCC and Industry Canada (IC) as a Modular Radio, the end user is authorized to integrate this module into an end-product, and is solely responsible for the Unintentional Emissions levels produced by the end-product.

In order to preserve the Modular Radio certifications, the integrator of the module must abide by the PCB layout recommendations outlined in the following paragraphs. Any divergence from these recommendations will invalidate the modular radio certifications and require the integrator to re-certify the module and/or end product.

The module must be used with one of the approved antennas:

- ½-wave center-fed dipole antennas tuned for 915 MHz with a maximum gain of 1.9 dBi or less, such as ANT-916-CW-HWR-SMA
- Chip Antennas with maximum gain of 0.3 dBi or less, such as ANT-916-USP

CHIP ANTENNA REFERENCE DESIGN



A reference layout design can be found in the Gerber file, *LL_RLP_ChipAnt Reference.zip*.

Design Guidelines

When using a chip antenna, this module can only be used with a host antenna circuit trace layout design in strict compliance with the diagram above and the following design parameters:

1. Trace layout and dimensions
   a) 50 Ohm CPL to antenna
      i) 70 mil width
      ii) 16 mil isolate
      iii) 62 mil FR4
   b) Chip antenna gain must 0.3 dBi or less

Design Verification

1. Output Power Measurement
   a) Place module in test transmit mode (continuous transmit)
   b) Connect U.FL on module to spectrum analyzer
   c) Set center frequency of spectrum analyzer to DUT frequency
   d) Place spectrum analyzer in zero-span mode, with RBW set to 1MHz
   e) Measure power level
   f) **Pass criteria**: Measured power level must be between +18dBm and +20dBm

2. Antenna Impedance Matching
   a) Calibrate Vector Network Analyzer (VNA) and test cables with at 915MHz
   b) Connect to antenna U.FL and measure S11 of antenna (P/N: ANT-916-USP)
   c) If SWR is greater than 2, add passive match elements as needed to improve match
   d) **Pass criteria**: SWR < 2

3. EIRP Test
   a) In an environment suitably free of reflectors (e.g. anechoic chamber), position a transmit antenna and receive antenna (of known gain) at a fixed distance
   b) Connect a signal generator tuned to 915MHz to the transmit antenna and set output power to 0dBm
   c) Connect a spectrum analyzer to the receive antenna with the following settings: CF = 915MHz, SPAN = 0Hz, RBW = 500kHz
   d) Measure received power
   e) Determine path loss with the following equation:

$$PL = P_{tx} - P_{rx} = (0 - L_{cable} + G_{tx\ antenna}) - (P_{rx_{meas}} - L_{cable} + G_{rx\ antenna})$$

   f) Replace TX antenna/source with DUT in continuous TX mode
   g) Measure received power
   h) Determine EIRP with the following equation:

$$EIRP = PL + P_{rx} = PL + (P_{rx_{meas}} - L_{cable} + G_{rx\ antenna})$$

   i) **Pass criteria**: EIRP between +19.2dBm and +20.3dBm

Production Verification

1. Output Power Measurement
    a) Place module in test transmit mode (continuous transmit)
    b) Connect U.FL on module to spectrum analyzer
    c) Set center frequency of spectrum analyzer to DUT frequency
    d) Place spectrum analyzer in zero-span mode, with RBW set to 1MHz
    e) Measure power level
    f) **Pass criteria**: Measured power level must be between +17dBm and +18dBm

REGULATORY COMPLIANCE INFORMATION

To satisfy FCC RF Exposure requirements for mobile and base station transmission devices, a separation distance of 20cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended.

The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

OEM Labeling Requirements for End-Product

The module is labeled with its own FCC ID and IC Certification Number. The FCC ID and IC certification numbers are not visible when the module is installed inside another device, as such the end device into which the module is installed must display a label referring to the enclosed module. The final end product must be labeled in a visible area with the following:

"Contains Transmitter Module FCC ID: {insert here}
"Contains Transmitter Module IC: {insert here}

or

"Contains FCC ID: {insert here}
"Contains IC: {insert here}

The OEM of the module must only use the approved antenna(s) listed above, which have been certified with this module.

OEM End Product User Manual Statements

The OEM integrator should not provide information to the end user regarding how to install or remove this RF module or change RF Related parameters in the user manual of the end product.

Other use manual statements may apply.

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC CAUTION: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Conformité aux normes FCC Cet équipement a été testé et trouvé conforme aux limites pour un dispositif numérique de classe B, conformément à la Partie 15 des règlements de la FCC. Ces limites sont conçues pour fournir une protection raisonnable contre les interférences nuisibles dans une installation résidentielle.

Cet équipement génère, utilise et peut émettre des fréquences radio et, s'il n'est pas installé et utilisé conformément ment aux instructions du fabricant, peut causer des interferences nuisibles aux communications radio.

Rien ne garantit cependant que l'interférence ne se produira pas dans une installation particulière. Si cet équipement provoque des interférences nuisibles à la réception radio ou de télévision, qui peut être déterminé en comparant et en l'éteignant, l'utilisateur est encouragé à essayer de corriger les interférence par une ou plusieurs des mesures suivantes:

- Réorienter ou déplacer l'antenne de réception.
- Augmenter la distance entre l'équipement et le récepteur.
- Branchez l'appareil dans une prise sur un circuit différent de celui auquel le récepteur est connecté.
- Consultez votre revendeur ou un technicien radio / TV pour assistance.Avertissement

Les changements ou modifications à cet appareil sans expressément approuvée par la partie responsable de conformité pourraient annuler l'autorité de l'utilisateur de faire fonctionner cet équipement.

Industry Canada Statements

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

This device complies with RSS-210 of the Industry Canada Rules. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This device has been designed to operate with the antennas listed in the filing, and having a maximum gain of 1.9 dBi. Antennas not included in this list or having a gain greater than 1.9 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Cet appareil est conforme avec Industrie Canada exempt de licence Rss standard(s). Son fonctionnement est soumis aux deux conditions suivantes : (1) cet appareil ne peut causer d'interférences, et (2) cet appareil doit accepter toute interférence, y compris des interférences qui peuvent provoquer un fonctionnement indésirable du périphérique.

Ce dispositif est conforme à la norme CNR-210 d'Industrie Canada applicable aux appareils radio exempts de licence. Son fonctionnement est sujet aux deux conditions suivantes: (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

Pour réduire le risque d'interférence aux autres utilisateurs, le type d'antenne et son gain doivent être choisies de façon que la puissance isotrope rayonnée équivalente (e.i.r.p) ne dépasse pas celle admise pour une communication réussie.

Cet appareil a été conçu pour fonctionner avec les antennes énumérées ci-dessous, et ayant un gain maximum de 6,0 dB. Antennes pas inclus dans cette liste ou ayant un gain supérieur à 6,0 dB sont strictement interdites pour une utilisation avec cet appareil. L'impédance d'antenne requise est de 50 ohms.

IMPORTANT NOTICE

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